Concepts for Next-Generation Spaceborne Precipitation Radars

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Global rainfall is the primary distributor of latent heat through atmospheric circulation. The recently launched Tropical Rainfall Measuring Mission satellite is dedicated to advance our understanding of tropical precipitation patterns and their implications on global climate and its change. The Precipitation Radar (PR) aboard the satellite is the first radar ever flown in space and has provided exciting, new data on the 3-D rain structures for a variety of scientific uses. However, due to the limited mission lifetime and the dynamical nature of precipitation, the TRMM PR data acquired cannot address all the issues associated with precipitation, its related processes, and the long-term climate variability. In fact, a number of new post-TRMM mission concepts have emerged in response to the recent NASA's request for new ideas on Earth science missions at the post 2002 era. This paper will discuss the system concepts for two advanced, spaceborne rainfall profiling radars.

In the first portion of this paper, we will present a system concept for a second-generation spaceborne precipitation radar for operations at the Low Earth Orbit (LEO). The key PR-2 electronics system will possess the following capabilities:

- A 13.6/35 GHz dual frequency radar electronics that has Doppler and dual-polarization capabilities.
- A large but light weight, dual-frequency, wide-swath scanning, deployable antenna.
- Digital chirp generation and the corresponding on-board pulse compression scheme. This will allow a significant improvement on rain signal detection without using the traditional, high-peak-power transmitters and without sacrificing the range resolution.
- Radar electronics and algorithm to adaptively scan the antenna so that more time can be spent to observe rain rather than clear air.
- Built-in flexibility on the radar parameters and timing control such that the same radar can be used by different future rain missions. This will help to reduce the overall instrument development costs.

In the second portion of this paper, we will present a system concept for a geostationary rainfall monitoring radar for operations at the geosynchronous Earth Orbit (GEO). In particular, the science requirements, the observational strategy, the instrument design, and the required technologies will be discussed.